

REMARKS

The Examiner has rejected Claim 19 under 35 U.S.C. § 112, second paragraph. Additionally, Claims 1-9, 11-14, 16, 19, 20 and 22-32 were rejected under 35 U.S.C. § 103(a) as being obvious over Harris et al (US2004/0228783) in view of Bender et al (U.S. 5,232,490). Claims 17 and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Harris et al in view of Bender, et al, further in view of Cheng (WO 02/22897). Claim 19 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Harris, et al, in view of Bender, et al, and further in view of Hamalainen (WO 03/035916). Claims 21 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Harris, et al, in view of Bender, et al, and further in view of Wesolowski, et al (U.S. 3,203,786).

Applicant notes that the Examiner has indicated that Claims 10 and 15 would be allowable if rewritten in independent form including all of the limitations of the base Claim and any intervening Claims.

As discussed below, Applicant respectfully submits that the pending claims are allowable and requests that the rejections be withdrawn and a Notice of Allowance issued.

Dependent Claims 10 and 15

As noted above, the Examiner has indicated that dependent Claims 10 and 15 were allowable if rewritten in independent form. Applicant has done this in new Claims 37 and 38. Applicant has also maintained dependent claims 10 and 15

The Section 112 Rejection

Applicant has amended Claim 19 and respectfully submits that said Amendment renders this rejection moot.

Section 103 (a) Rejection

Applicant has amended Claims 1, 2, 5, 8, 9, 10, 11, 12, 14, 15, 28, 29, and 30. Applicant submits that the pending Claims are allowable for the reasons set forth below.

The Examiner considers that while Harris does not disclose the addition of sulfuric acid to the metal chloride solution to regenerate HCl, Bender does disclose such a process. The Examiner considers that a person of ordinary skill in the art would use sulfuric acid addition in place of Harris' pyrohydrolysis stage.

However, the sulfuric acid addition of Bender is to avoid calcium build up, and to precipitate jarosite. Jarosites absorb heavy metals in solution (including any Pb and Ag, i.e. target metals), and are environmentally unstable. Thus, when jarosites are removed they can extract target metals from the solution and they can also release heavy metals into the environment when they are disposed of (e.g. in landfill). The application as-filed clearly and distinctly points out that when the total chloride molarity is in the range of 6 to 8M (page 18, line 10), and a minimum of 30 g/L of CaCl_2 is maintained in the leach, jarosite formation can be suppressed, thus promoting iron precipitation as haematite (page 18, lines 27 to 29).

Therefore the sulfuric acid addition from Bender into the Harris process will result in jarosites forming. Jarosites, and how they should be dealt with, are not referred to in Harris. However, they will cause additional problems in the Harris process that have simply not been contemplated. This, in itself, would require inventive faculty to overcome.

Further, the use of sulfuric acid addition in *situ* then prevents the pyrohydrolysis stage of Harris from being able to be performed. Pyrohydrolysis would not be possible as it generates HCl and MgO. This would thus result in excess HCl being generated, as HCl is being generated in *situ*, as well as in the pyrohydrolysis stage.

Alternatively, if the pyrohydrolysis stage is replaced with the sulphuric acid addition step from Bender, as proposed by the Examiner, it would also be necessary to alter the precipitation agent being used – which is MgO in Harris.

Applicant respectfully submits that these differences and/or problems associated with mere substitution or inclusion of a step from the Bender disclosure into Harris are not straightforward, and instead requires inventive contribution. Specifically, it was surprisingly discovered that HCl can be generated in situ and $\text{CaCO}_3/\text{Ca}(\text{OH})_2/\text{CaO}$ used for precipitating, so long as the brine comprises at least 30 g/L of CaCl_2 unwanted jarosites will form.

Claims 1 and 30 now specify that the metal halide is calcium chloride, that the total chloride molarity is 6 to 8M, at least 30 g/L of calcium chloride is maintained in the process/leach solution. Applicant notes that the Examiner provided some specific comments on Claims 28 and 29, where he indicated that Harris disclosed a total chloride molarity of 5.64-14.10M, and a minimum calcium chloride concentration of 63 g/L. While it is unclear how the Examiner arrives at this concentration (even assuming that he did not take paragraph [0051] into consideration, the concentration by Applicant's calculations is 53), Applicant respectfully directs the Examiner to paragraph [0051] where it is specified that the "amount of additional metal chloride and cation may be 1-25wt % of the amount of magnesium chloride.

It seems, therefore, that the Examiner has failed to take into consideration this limitation when calculating the calcium chloride concentration disclosed in Harris. Whilst calcium chloride concentration of 63 g/L was not obtained when performing Applicant's calculation, assuming that this concentration is correct, it would still need to be further divided by 4 (i.e. 15.75g/L). However, Applicant respectfully submits that the maximum calcium chloride concentration disclosed in Harris is in fact 15.38g @ 200 g/L of total chloride. The basic working showing show this result was achieved as provided below.

Calculation of calcium chloride concentrations:

MgCl₂: 1 mole Mg = 24.3 g, 2 moles Cl = 71 g

HCl: 1 mole H = 1, 1 mole Cl = 35.5

Mass of Mg / mass of HCl = 0.1

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At 1 mole HCl, ration of Mg to HCl is:

Mass of Mg/mass of HCl = 0.1 = $24.3\text{g} * a / 36.5\text{g} = 0.1$, $a = 3.65/24.3 = 0.15$

$$\text{Mass of Mg} = 24.3 \times 0.15 = 3.65 \text{ g per 1 mole of HCl}$$

Total mass of chloride can be obtained by substituting chloride masses for the Mg and HCl mass:

$$\text{mass of chloride associated with Mg at 1 Mole HCl} = 71 \times 0.15 = 10.65 \text{ g}$$

$$\text{mass of chloride associated with 1 Mole HCl} = 35.5 \text{ g}$$

$$\text{total chloride from MgCl}_2 \text{ and HCl at 1 mole HCl} = 10.65 + 35.5 = 46.15 \text{ g}$$

Minimum chloride in lixiviant is 200 g/l:

$$\text{Minimum moles of HCl} = 200 / 46.15 = 4.3 \text{ moles}$$

$$\text{Mg mass at 200 g/L total chloride is } 4.3 \times 3.65 = 15.7 \text{ g of Mg}$$

$$\text{And the mass of MgCl}_2 = 15.7/24.3 \times (24.3+71) = 61.5 \text{ g}$$

Calcium chloride substitution can be 1-25 wt% of the MgCl_2 .

Hence, the range of calcium chloride will be 1-25% of 61.5 = 0.615 g – 15.38 g @ 200 g/L total chloride.

If the upper range of 500 g/l: total chloride (see paragraph [0102] of Harris) is used, the range of calcium chloride will be 1-25% of 155.0 = 1.55 g – 38.76 g.

However, in Harris, at 500 g/L total chloride, there is an excess of HCl. This excess of HCl would negate the ability of calcium to prevent jarosite formation. Thus, it would be ineffectual and jarosites would still form and, when precipitating, would strip the target metals out of solution.

However, the total chloride molarity of the present invention is limited to 6 to 8M (equivalent to a concentration of 213 – 284 g/L). This prevents an excess of HCl forming, thus allowing the calcium present to prevent jarosite formation. If these total chloride concentration ranges were substituted into Harris, the calcium chloride would be limited to 16.4 – 21.8 g/L. These concentrations of calcium chloride are insufficient to prevent jarosite formation.

Applicant therefore respectfully submits the Claims 1 and 30, as amended, are novel and inventive over Harris and Bender. While Bender is silent on the amount of calcium in the system, according to column 15 lines 12-13, calcium build-up is to be avoided. This would

therefore indicate that a minimal amount of calcium be introduced into the process solution, rather than having a minimum of 30 g/L of CaCl₂ being maintained in the process solution.

Accordingly, Applicant respectfully submits that the pending claims are allowable over the cited art and requests that a Notice of Allowance be issued. In the event the Examiner believes that there are any remaining issues to be resolved, the Examiner is encouraged to contact the undersigned attorney.

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Respectfully submitted,

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